3. RETRIEVAL FACILITY DESCRIPTION

The designs presented in this section are preliminary in nature and were developed sufficiently for alternative selection and cost analysis and will change as the design progresses. A retrieval facility will be designed and constructed to support retrieval operations for the Pit 9 Remediation Project (see Figure 23). The facility design for Alternative 1 is different than Alternatives 2 and 3 (see detailed drawings in Appendix B); Alternative 1 is approximately 4 ft taller and 40 ft longer to accommodate the overhead crane. The facility design for Alternatives 2 and 3 is the same. This section describes the modifications required to site the facility and various significant features of the facility that will be required to perform retrieval. Any variances between the alternatives are noted.

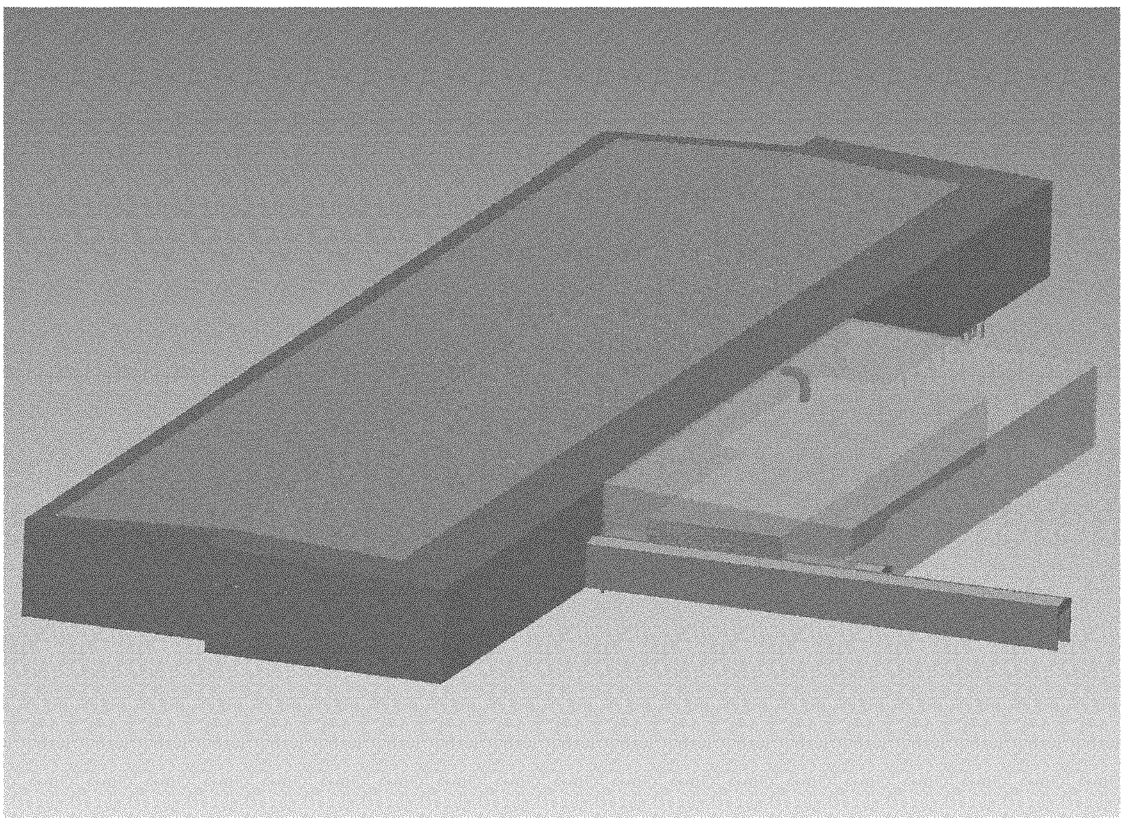

Figure 23. Retrieval facility.

The dimensions of the retrieval facility for each alternative are listed in Table 1.

Table 1. Retrieval facility exterior dimensions.

Dimensions	Alternative 1	Alternative 2	Alternative 3
Width	193 ft 3 in.	193 ft 3 in.	193 ft 3 in.
Height	46 ft 6-1/2 in	42 ft 6-1/2 in.	42 ft 6-1/2 in.
Length	695 ft 3 in.	655 ft 3 in.	655 ft 3 in.

3.1 Site Development

3.1.1 Site Location

The project site is located at Pit 9 on the northeast corner of the SDA, immediately west of the RWMC Operations area at the INEEL (see Figure 24). The area just to the west of Pit 9, which currently includes structures owned by LMAES, is used for mads, the siting of buildings and equipment, and work area operations. The GEM project currently has structures located on or near Pit 9, most of which will be removed prior to the start of Stage III construction.

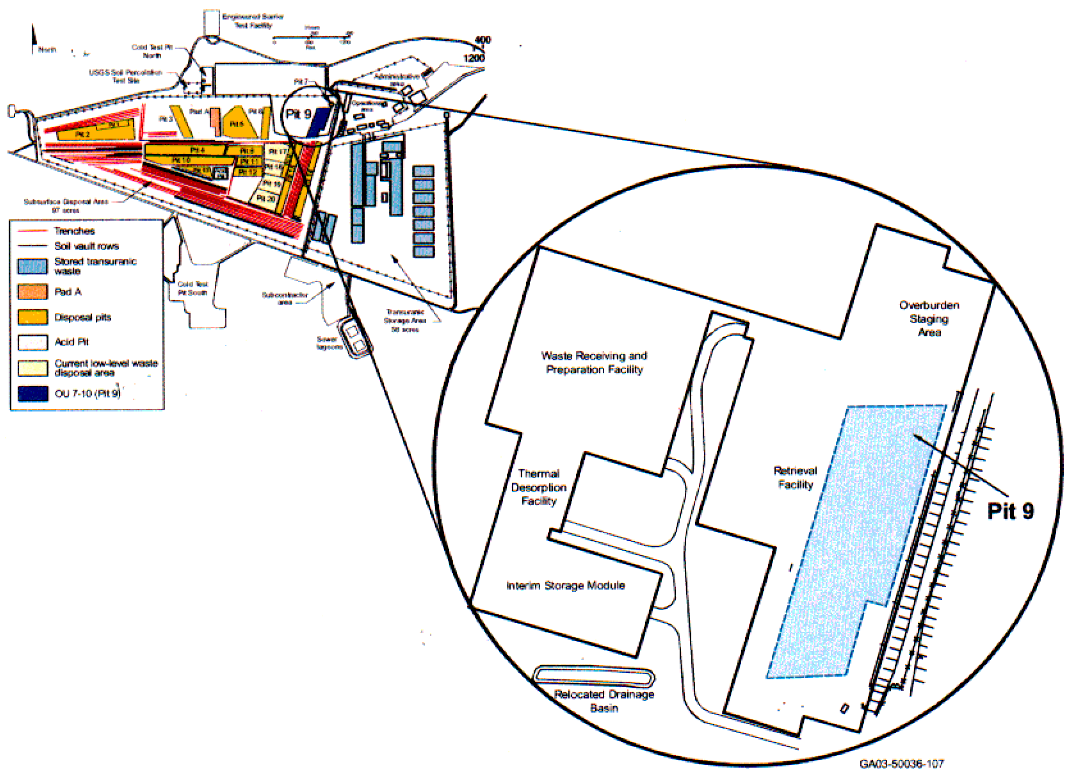

Figure 24. Pit 9 location.

3.1.2 Site Characterization

The site for the retrieval structures has been modified from its natural condition. The original site soils were mostly wind deposited silts on top of lava bedrock (basalt). Originally Pit 9 was excavated to the basalt. The depth to basalt varies from about 4.9 to 7.6 m (16 to 25 ft), averaging about 5.3 m (17.5 ft). When the pit was filled, 1.1 m (3.5 ft) of clean soil was placed over the basalt as underburden, about 2.4 m (8 ft) of waste was added, and the waste was covered to grade with up to 1.8 m (6 ft) of clean clay and silt soil (overburden). When the pit was closed, it contained about 7,079.2 m^3 (250,000 ft^3) of overburden, 4,250 m^3 (150,000 ft^3) of packaged waste, and 9,911 m^3 (350,000 ft^3) of soil between and below the buried waste. No other waste disposal has occurred in Pit 9 since its closure in 1969, but additional overburden has been added over the years to fill in areas of subsidence and for drainage and flood control. Pit run gravel fill has been added to some areas on and around Pit 9. The overburden has an average depth of 6 ft.

The waste disposed of in the initial waste seam was in containers that had external surfaces generally free of contamination. Upon backfilling the pit, the void volume between the loose packed containers became occupied by initially clean soil, referred to as interstitial soil. The containers may have subsequently rusted or otherwise failed, allowing waste or waste contaminants to migrate from the initial containers to the interstitial soil, the underburden, and the overburden. Although volatile and liquid organic waste is known to have migrated significant distances relative to the dimensions of a waste container, the degree of migration is not well known; the degree of migration of transuranic materials is even less well known.

3.1.3 Description of Existing Site

Pit 9 occupies a 115 x 400 ft portion of the SDA, and consists of a waste pit situated between two concrete rail support structures originally intended to support the LMAES retrieval building (see Figure 25).

Existing Probes, Structures, and Facilities. A number of observation and sampling probes have been installed throughout Pit 9. These probes will be removed during retrieval operations.

The main structures located in the Pit 9 area are the LMAES process building, LMAES retrieval building, and concrete rail support structures (see Figure 25). It is assumed that these buildings and structures will be removed by others before construction begins. The existing LMAES retrieval building and steel rails must be removed before construction begins on the new retrieval facility and the process building must be removed before construction begins on the treatment facilities. The concrete structural pads and the steel piles supporting them will be used as part of this project. Field investigation and testing will be required to verify the quality of any existing structures prior to use.

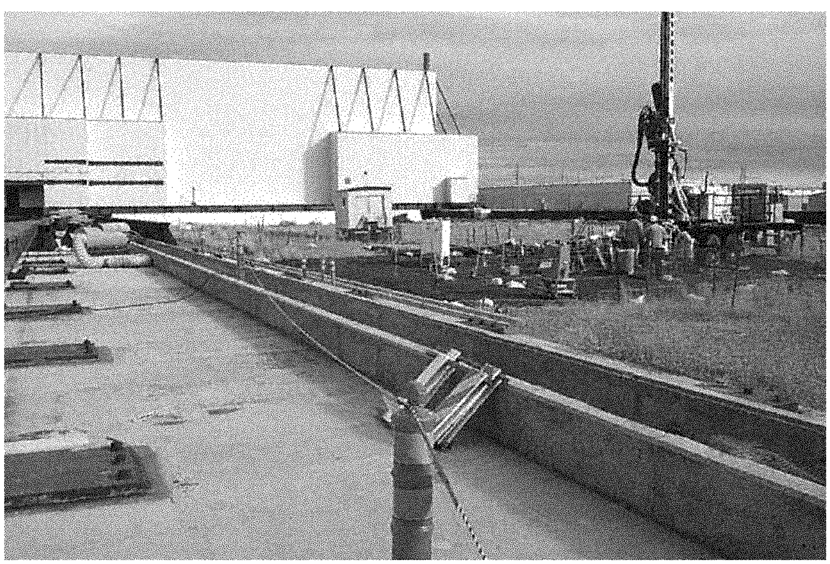

Figure 25. Concrete pad and LMAES Retrieval Building on Pit 9.

A fire riser building supplies a dry-pipe fire protection system for the GEM project structures. This structure will be retained, if adequate, to service this project.

Also located in the project area are a storm water detention basin and a concrete catch basin that connects to an underground piping system. These basins hold rain and snow melt to help prevent flooding. The following section describes the basins in more detail.

SDA Storm Water Drainage and Control. Rain and snow are the only natural sources of water for the SDA and Pit 9 areas, and must be controlled to prevent flooding of the SDA and Pit 9 area. Localized runoff from within the SDA is safely controlled through an existing engineered internal drainage system. Surface water runoff within the interior of the SDA discharges to the main RWMC drainage channel along Adams Boulevard and channels through the concrete, storm water detention basin located on the east end of the SDA (see Figure 26). The storm water detention basin collects the runoff of internal storm water from the SDA for sampling and to allow sediments to settle before the water is pumped to the main channel. The storm water detention basin, which has a storage capacity of 70,400 ft^3, is equipped with a 6-hp, 400-gal/minute sump pump that pumps detained storm water from the detention basin through a 4 in. discharge pipe into one of two 30-in. culverts that connect to the main channel. In overflow flood conditions, the culverts can handle up to 56 ft^3/second when the culvert outlet is submerged, and 66 ft^3/second when there is free flow in the channel.

The detention basin, catch basin, pumps, and piping system will all need to be relocated or modified as part of this project. In addition, a dike system located around the SDA protects the area from external floods. The portion of this dike system located close to the Pit 9 area must be modified as part of this project.

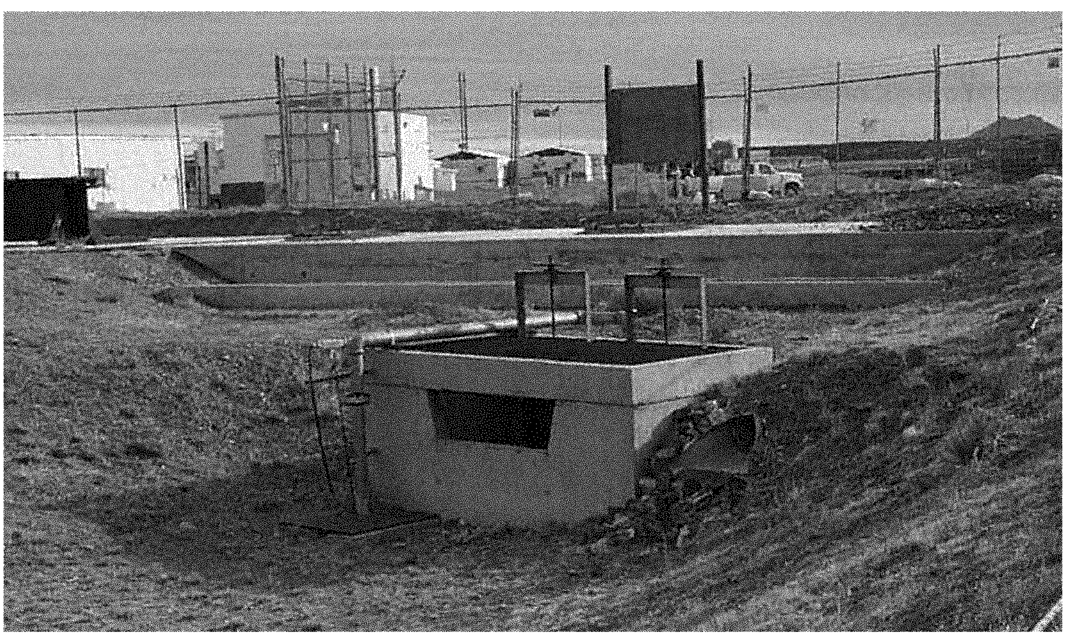

Figure 26. Storm water detention basin with concrete catch basin and pump.

Existing RWMC Roads. The main access road to the project areas is proposed to be Madison Ave., which enters the Pit 9 area from the north. The roads in this area are gravel, and will require periodic grading and maintenance during construction.

During operations, personnel will access the site by an RWMC road that enters the site south of Pit 9. This road is currently in good condition but is unpaved within the SDA.

3.1.4 Site Development and Utilities

New Roads and Parking Areas. RWMC roads and parking areas will be used to the extent possible. The access road at the south end of the Pit 9 area will be relocated and paved with asphalt. Additional asphalt access roads and parking areas will be provided in the vicinity of the new buildings.

Gravel Fill, Culverts, Ditches and Storm Water Drainage. The storm water drainage system will be modified to provide a new storm water detention basin with additional culverts, ditches, and fill necessary to collect and transfer storm water from the SDA to the main RWMC drainage channel. The sizes of the basin, culverts, and ditches will be consistent with the existing system. The SDA dike system will be modified to accommodate the new retrieval building (see Figure 27).

Firewater. The fire-riser building (WMF-750), if adequate, will supply the dry-pipe fire protection systems for the retrieval process and support areas.

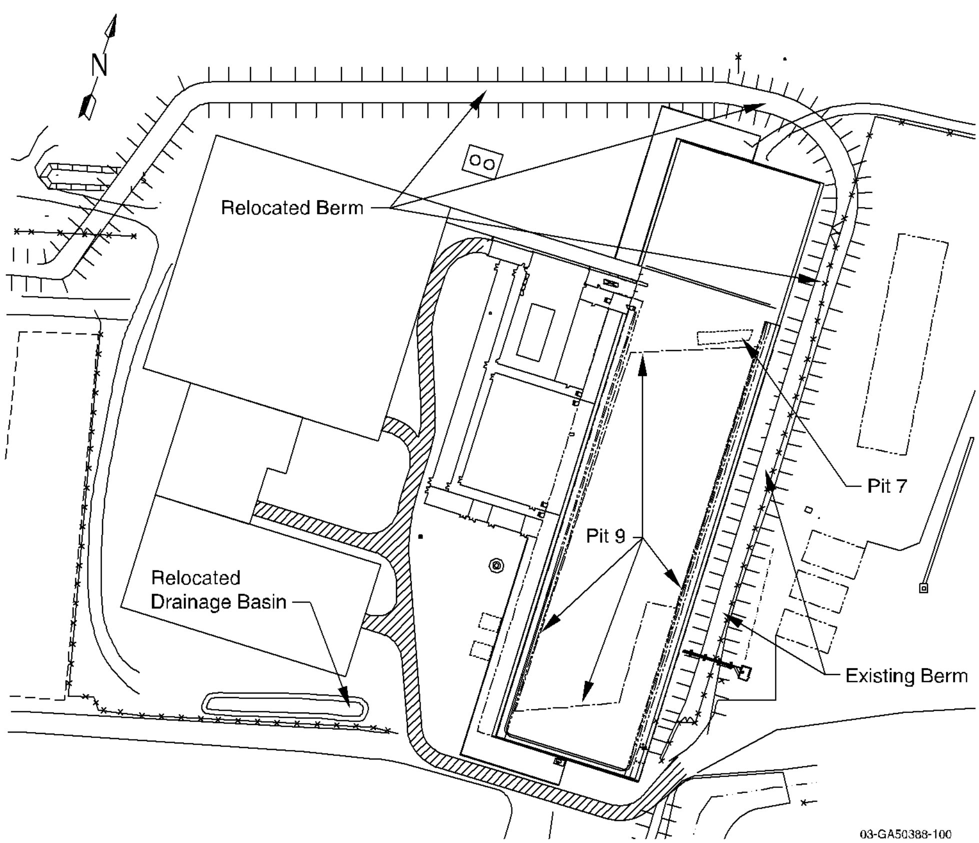

Figure 27. Relocated SDA earth berm, drainage basin, and pit locations.

Electrical Substation. Power for the new treatment and retrieval facilities will be provided via the INEEL 138 kV Substation 9 located north of the proposed retrieval facility. The substation yard was built by LMAES and is presently owned and operated by the INEEL down to the secondary 4,160 V cable that feeds the LMAES powerhouse. The powerhouse is owned and controlled by LMAES. The total capacity of the existing substation is 12 MVA. A new powerhouse will be required to service the new treatment and retrieval facilities. This powerhouse will contain the required 4,160 V switchgear, standby generator, control power battery bank, and relays for the high-voltage transmission system. Design requirements for the new powerhouse can be found in the *Treatment Alternatives Feasibility Study for the Pit 9 Remediation Project* (INEEL 2003c).

3.2 Architectural

Preconceptual layouts were developed for each alternative. Associated drawings can be found in Appendix B.

3.2.1 Building Layout

The retrieval portion of the Pit 9 Remediation Project includes one main-structure, which is divided into several areas as illustrated in Figure 28.

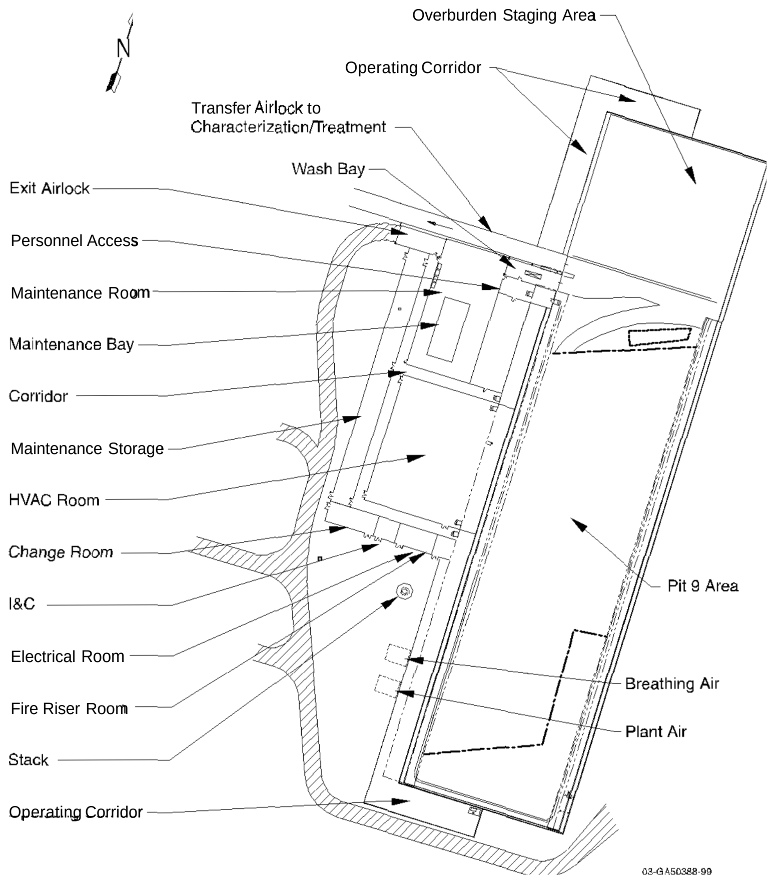

Figure 28. Identified retrieval structure areas.

Primary Confinement Areas. The retrieval facility has seven areas currently identified as needing primary confinement, the retrieval area, crane maintenance area, transfer airlock, wash bay, exit airlock, maintenance bay, and portions of the heating, ventilating, and air conditioning (HVAC) room (see Figures 29 and 30). All surface finishes inside a primary confinement will be designed to accommodate decontamination and wash-down activities, as appropriate.

Retrieval Area—The retrieval area is the largest space within the retrieval facility (Figure 29). This area is comprised of the pit area, overburden staging area, and the region located between these two areas. These areas are within the primary confinement boundary. The retrieval area will also house the remote waste retrieval equipment used to remediate the pit. The overburden staging area extends to the north of the pit and is used for stockpiling the lower portion of the overburden prior to waste retrieval and return of the overburden after retrieval is completed. It is anticipated that the overburden staging area will be constructed to RCRA standards to support any deactivation, decontamination, and decommissioning (DD&D) cleanup activities that would require a large basin to hold any decontamination fluids.

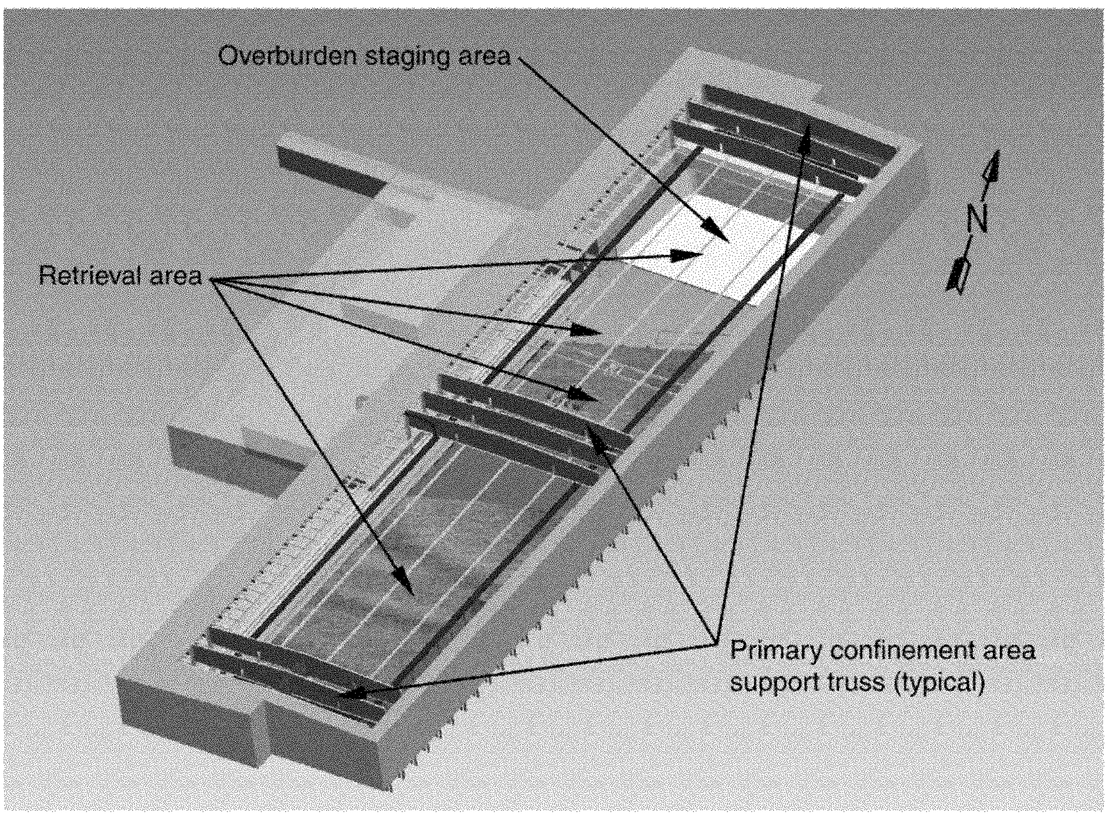

Figure 29. Retrieval area primary confinement.

Crane Maintenance Area—Alternative 1 uses cranes housed inside the retrieval area to support waste retrieval operations, therefore, a crane maintenance area is included in this alternative (see Figure 30). This area will have a curtain or divider that allows it to be separated from the main retrieval area and only opened when required to maintain crane operations. The crane maintenance floor is also elevated to help maintenance operations on the cranes and limits the need for personnel to work at elevated heights.

Transfer Airlock—An airlock corridor connects the retrieval area to the waste characterization building to ensure a controlled transfer of designated overburden and waste seam materials for characterization (see Figures 28 and 30). It also enables the controlled transfer of pit materials being returned for final disposal.

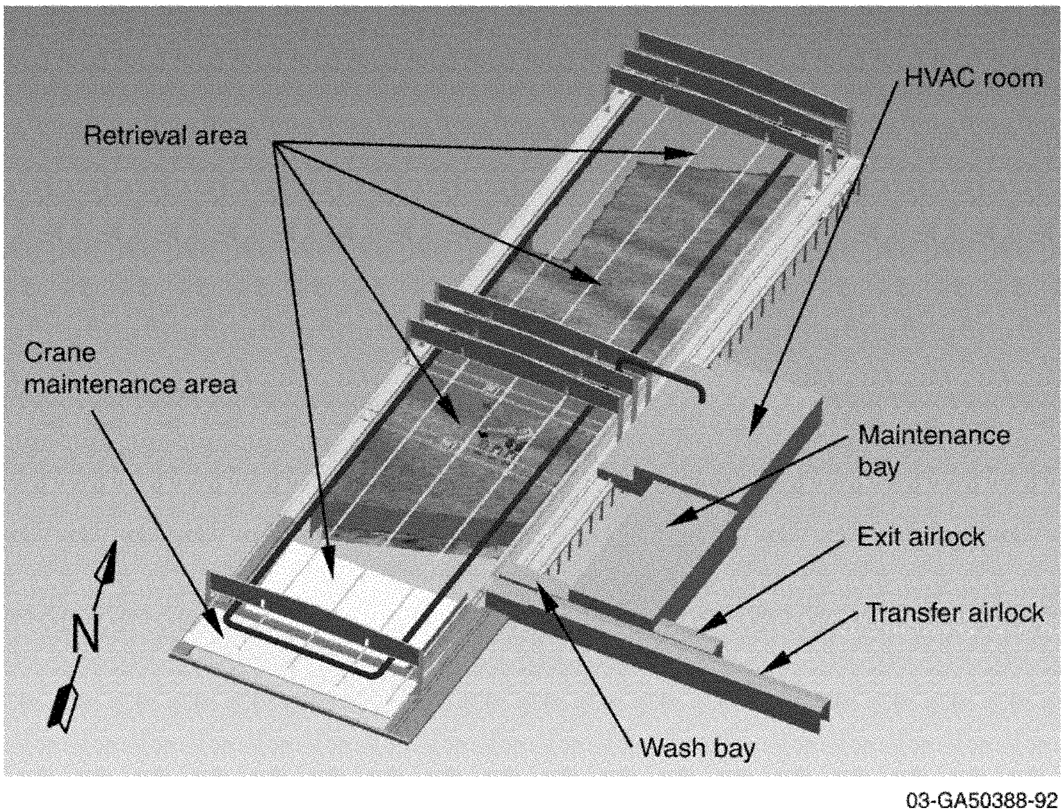

Figure 30. Primary confinement areas.

Wash Bay—This area provides wash-down and decontamination capabilities for equipment entering the maintenance bay or exiting the facility. Personnel and equipment entry and exit are controlled by an airlock system. Decontamination fluids are captured in a sealed catch basin, held for sampling, and filtered prior to reuse. The filtered fluids are used inside the retrieval area for maintaining a certain moisture level in the pit soils. All surface finishes inside the wash bay are designed to accommodate decontamination and wash-down activities.

Exit Airlock—The exit airlock maintains controlled entry of large replacement parts needed for retrieval equipment maintenance or replacement equipment, if necessary. The airlock will also allow controlled exit of items or equipment that have been sufficiently decontaminated.

Maintenance Bay—The maintenance room is divided into two areas, a contaminated equipment storage area and a maintenance bay area, considered a primary confinement, to ensure that the equipment disassembly process does not release contamination into the rest of the room. The maintenance bay area is considered a primary confinement and is where retrieval equipment modules will be changed out, equipment will be disassembled and repaired as required, and routine maintenance activities will take place. This area will be designed to enable some remote maintenance activities, while other activities will require appropriately protected personnel inside the bay. It is expected that at least portions of the bay walls will have view ports and glove ports as required to perform certain duties. A personnel airlock will provide controlled access of personnel suited up in personal protective equipment.

HVAC Room—The HVAC room will have areas separated into primary confinement based on the equipment and ducting that is located inside that portion of the room. Portions of the supply and return ducts that penetrate the retrieval area will also be considered primary confinement and part of the equipment/ducting. This area will house the high-efficiency particulate air (HEPA) filter banks, fans, and other HVAC equipment. Equipment platforms will provide access for maintenance and change-out of HEPA filters and miscellaneous parts required for the HVAC system. View ports and glove ports will be provided, as appropriate, around the perimeter walls to allow limited remote capabilities. Personnel suited up in personal protective equipment can make manned entries for most activities.

All surface finishes within primary confinement are designed to accommodate decontamination.

Secondary Confinement Areas. Secondary confinement will be associated with each primary confinement (see Figure 3 1). The following discussion identifies specific regions that are considered secondary confinement. Surface finishes and equipment located inside a secondary confinement will be designed to accommodate decontamination and wash-down activities, as appropriate for the level of risk.

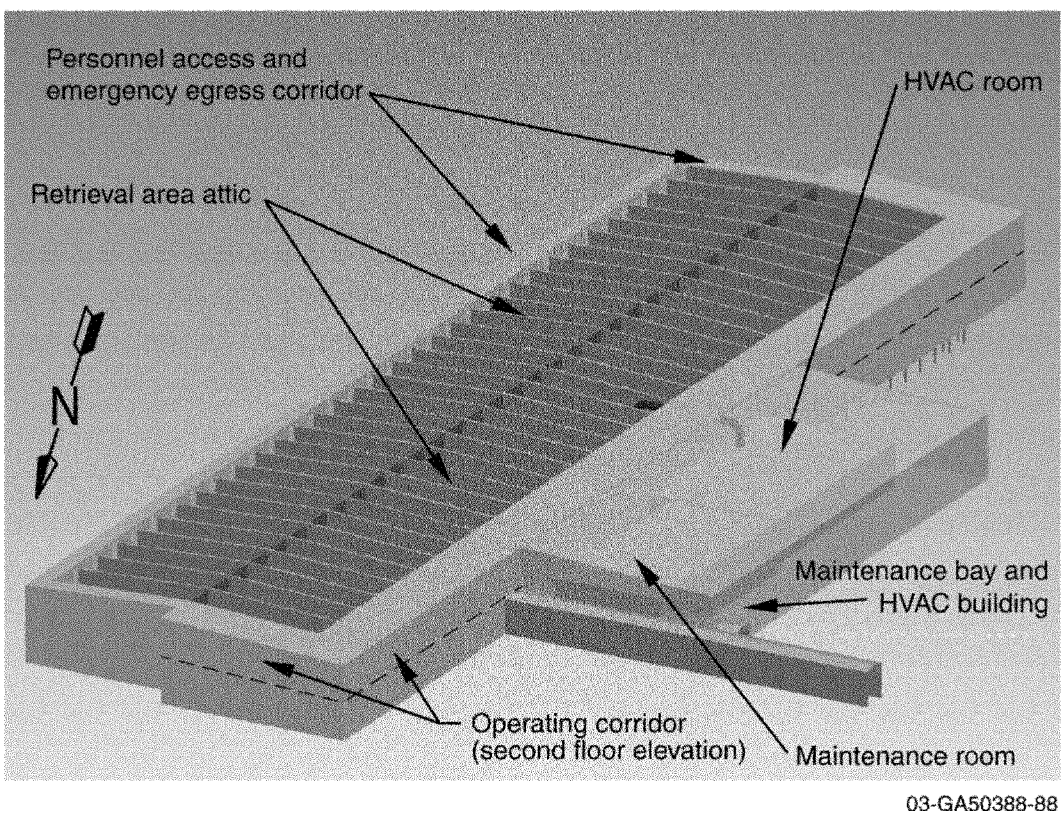

Figure 3 1. Secondary confinement areas.

Retrieval Area Attic—The retrieval area building consists of trusses spaced equally from one end of the area to the other (see Figure 32). Primary confinement skin is attached to the bottom of these trusses, and roof skin is attached to the tops of the trusses. The spaces created between each truss, primary skin, and roof skin form a secondary confinement zone. The zones are sealed from each other using skins on each truss. Access doors allow zone-to-zone access on either the east or west sides of the structure. The east and west sides of the building are sealed from each other, but could be modified to allow access by adding sealed doors at various locations. Attic access is provided to allow periodic lighting, camera maintenance, and radiological surveys.

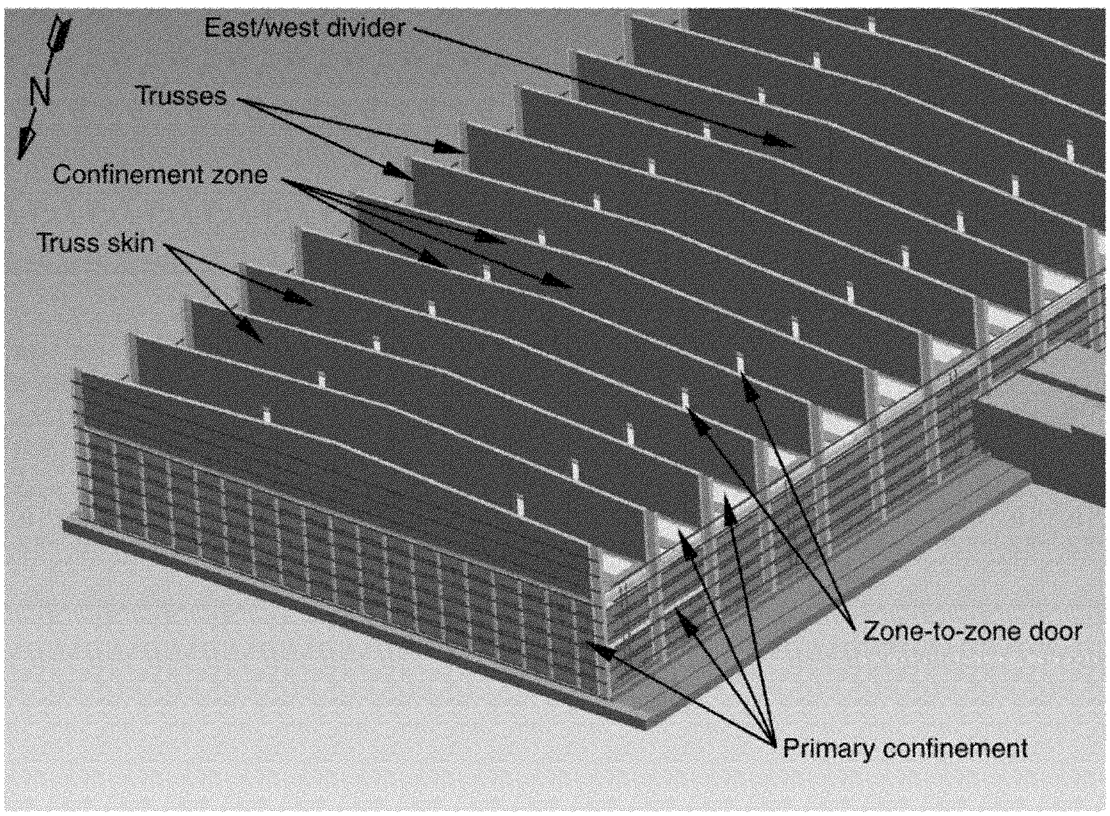

Figure 32. Retrieval area attic.

Access to the retrieval area attic is gained through doors at appropriate locations. Personnel can access the doors by going up ladders and using catwalks placed in each zone of the secondary confinement. Personnel would access the truss space located between the primary confinement wall and the secondary wall fabric roof to perform any monitoring and maintenance activity required to ensure continued operations.

Operating Corridor and Rooms—The operating corridor is located on the west side of the retrieval area, on the mezzanine elevation. This elevation gives a vantage point from above for operational personnel. Space is allotted for mobile control consoles, view ports for line-of-sight control panel operations, and desks. The operating corridor also allows personnel access to the entire length of the building without leaving the corridor and the west half of the retrieval area roof, which is also a secondary confinement.

The grade level portion of the operating corridor does not run continuous along the entire length of the structure. The HVAC room, wash bay, and transfer airlock intersect the grade level corridor to service the retrieval area. This level will house such items as piping, electrical conduit, equipment storage, supply storage, a personnel change room, etc. Personnel change rooms will be located at the main facility entry point, at grade.

HVAC Room—The portion of the HVAC room outside the primary confinement section serves as the secondary confinement for the HVAC system. This area may house HEPA filter banks, fans, and other HVAC equipment.

Maintenance Room—The maintenance room is divided into two areas, a contaminated equipment storage area and the primary confinement maintenance bay. The exterior walls of the maintenance room provide the secondary confinement boundary. Appropriate access and exit doors are provided.

Personnel Access and Emergency Egress Corridor—A corridor located on the east side of the retrieval area will provide personnel access and emergency egress. The corridor provides access to the east half of the retrieval area roof, which is also a secondary confinement. The corridor also provides emergency egress from the primary retrieval area for personnel inside the primary confinement.

Appurtenances—A fueling connection is available for refueling diesel powered retrieval equipment. Air connection(s) are available for cleaning equipment exhaust scrubbers. These connections are located in the retrieval area with the equipment, and pass into and possibly out of the secondary confinement.

Additional work will be conducted in the conceptual design phase to establish the actual interfaces to the primary and secondary confinements.

Areas Not Requiring Confinement· The retrieval facility will have areas that are not expected to require confinement (see Figure 28). These areas are described below.

Change Room(s) or Change Area(s)— Areas will be provided for personnel to change into and out of work clothes, shower, and other associated activities in support of retrieval operations.

Operations Offices—Workspace will be provided for operation-critical support including the RadCon technician, Industrial Hygienist, and operations supervisor.

Fire Riser and Equipment Room—The main fire riser for the facility fire protection system will be located in an isolated room along with associated controls and alarms.

Electrical Room—The electrical room will contain the electrical and communications panels and switchgear for distributing electricity throughout the facility.

Instrument and Control Equipment Room—The instrument and control system distribution panels and controls will be located in an isolated area. The subsystem services include radiological, emissions, and criticality monitoring; facility monitoring and control; and visual monitoring accomplished through remote cameras and televisions.

Maintenance and Equipment Storage Area—The storage area will be provided for replacement and maintenance items required frequently for facility operations (HEPA filters and miscellaneous parts for retrieval equipment).

Maintenance and HVAC Building Corridor(s)—Circulation corridors are around the maintenance and HVAC rooms with view ports to allow personnel to view activities inside various rooms.

Miscellaneous Systems—Miscellaneous systems, including breathing air and plant air, will be accommodated through skid-mounted compressors located outside the retrieval facility.

3.2.2 Building Occupancy

The occupancy classification for the Pit 9 Remediation Project under the National Fire Protection Association 101 *Life Safety Code* is Industrial Ordinary Hazard, General, and Special Purpose Industrial

The occupancy classification per the *International Building Code,* 2003 Edition, is Group F-1, factory industrial, moderate hazard.

Personnel exits for occupied areas (for emergency use only) comply with building code and life safety code requirements.

3.2.3 Architectural Features

The retrieval building consists of a structural frame that supports both the exterior fabric skin and interior metal liners for primary and secondary confinement. The framed space of the structure between the inner liner and outer skin serves as corridors for operations and circulation. The outer shell consists of an insulated fire-resistant fabric skin. The interior liner is a rigid structure with an easily decontaminable surface finish.

The overhead doors at the airlock entries are a 3 to 4-fold panel system capable of withstanding 20 psf or a 90 mph wind. They will be insulated and easily decontaminable.

3.3 Structural

The primary confinement areas of the retrieval building are classified as safety significant. See *Hazard Identification Document for the OU7-10 Stage III Project* (INEEL 2003a) for a preliminary list of safety significant systems, structures, and components (SSCs). The structural framing systems are therefore Performance Category 2 (PC-2) per DOE-STD-1021 guidance. All structural systems that support or interact with the primary confinement will be designed to the PC-2 requirements. The retrieval building is designed to safely confine the waste seam retrieval process.

Structures that do not interact with safety significant SSCs, do not have the potential to damage a safety significant SSC and are not independently identified as safety significant, will be designed to PC-1 requirements.

Its main structural framing is a braced frame/truss system. The structural framing material is structural steel. The primary confinement boundary consists of modular carbon steel panels covered with 16-gage, stainless-steel sheets. The outer weather barrier is an insulated fabric. Interior corridors, exit pathways, and stairways between the primary confinement and the weather barrier will be framed with metal studs where necessary. The main framing system for the heating and ventilation rooms, decontamination areas, airlocks, and other structures are of structural steel.

The major structural systems will be designed to:

- Support applicable loading from personnel, equipment, other minor structures, and support systems and components as required by applicable codes and standards.

- Support applicable natural phenomena loading per DOE Performance Category 2 requirements and per the requirements of the International Building Code.

- Safely confine the waste seam material.

- Resist design basis accidents or events such as sloughing of the waste seam materials or small fires within the confinement area.

- Withstand negative pressures imposed by the ventilation system, including both normal and maximum operating pressures.

The major design standards, codes, and specifications used for designing the retrieval structures are the *DOE-ID Architectural Engineering Standards, International Building Code,* the American Institute of Steel Construction's *Specification for Structural Steel Buildings-Allowable Stress Design,* or other American Institute of Steel Construction specifications such as the *LRFD Specification for Structural Steel Buildings.* Any concrete used for this project will comply with the requirements of American Concrete Institute 318, "Building Code Requirements for Structural Concrete."

A ventilation exhaust stack approximately 4 ft in diameter and 60 ft tall will be located in close proximity of the HVAC room and HEPA system. The stack will be capable of accommodating an emissions monitoring system.

3.4 Fire Protection

Fire protection shall include necessary and appropriate code compliant fire protection systems for each process and associated identified hazards. Wet and dry pipe deluge, spray, and foam systems are systems to be considered.

Preliminary sizing indicates that the RWMC fire system will provide adequate fire water to supply the facility fire suppression systems and provide a way for the INEEL Fire Department to conduct manual suppression of fire-ground operations. Connections to the RWMC fire water system will be sized to provide required flows and pressures for the most demanding automatic suppression system.

Fire hydrants, accessible by fire department apparatus, will be located in accordance with applicable requirements of the National Fire Protection Association, INEEL, and RWMC.

3.5 Mechanical

Mechanical systems currently identified with the facility are described below.

3.5.1 Dust Suppression System

A dust suppression system will be designed as an integral factor in preventing pollution and minimizing waste relative to decontamination, decommissioning, and air-filter loading. This system will also be an integral factor in providing better visual space and better contamination control relative to industrial safety and hygiene.

The three operations causing concern for dust generation are digging, open transfer, and dumping activities. The following methods and systems available for dust suppression and control:

- Dry fog system
- Mist system
- Fixatives
- Local ventilation system.

Window and lens fogging will be considered during conceptual design.

3.5.2 Breathing Air System

The design will provide breathing air for potential entries into contaminated areas. Actual appropriate respiratory protection (hoods, full face masks, and bubble suits) is based on potential contaminants and respiratory protection factors. Features designed into the building structures (bulkhead fittings and notches in doors for airline routing) will be considered.

A portable, self-contained trailer with a compressor system will supply the breathing air. The trailer will be located as shown in Figure 28. Power for the trailer will be routed and tied into a 460 Vac power source. No other utilities or tie-ins are required. At present, there are five breathing air trailers located throughout the various INEEL areas. Arrangements for obtaining a trailer will be made ahead of time to ensure availability.

3.5.3 Plant Air System

Plant air will be supplied by an air compressor sized to provide the required capacity and pressure to support other systems such as the dust suppression system, HVAC System, and dust filter blowdown.

3.5.4 Fuel Tank Systems

Properly sized, aboveground tanks will provide fuel storage. The fuel will be used for diesel equipment.

3.5.5 Heating and Ventilation

Design considerations for the HVAC system includes occupant comfort and activity in occupied areas; chemical, radioactive, and exhaust emission hazards; dust control; confinement zone classifications (relative pressure differentials); credible breach face velocity; air change rates; exhaust rates and emissions; recirculation rates; and indoor air quality. The HVAC system is integral to industrial safety and hygiene practices, passive safe shutdown philosophy, indoor air monitoring, and exhaust stack emissions monitoring.

A preconceptual HVAC design was developed for each alternative (see HVAC flow diagrams in Appendix B; Sheets 1-HV-1, 2-HV-1, and 3-HV-1). This information was used to establish the overall design feasibility and associated costs of each alternative.

3.6 Electrical and Instrumentation

3.6.1 Power

Power to the retrieval facility will be supplied from the existing 4,160 V Pit 9 substation. The parts of the substation that will be reused consist of the 138 kV/4,160 V transformer and voltage regulators. This equipment is limited by a transformer that can supply a maximum of 12 MVA. This equipment is under the control of Power Management.

The secondary of the transformer will be connected to a new powerhouse that will consist of 4,160 V switchgear with automatic transfer switch and standby generation as required to supply the demands of both the retrieval and treatment facilities. The powerhouse design will be performed under the treatment portion of the project. The major part of this power will supply the required air movement and filtering systems. Power distribution inside the facility will consist of a 480 V commercial and stand-by power to feed the equipment. Equipment that requires emergency back-up power will be supplied by an uninterruptible power supply.

Grounding will be accomplished through an Ufer ground instead of driven electrodes. In place of driven electrodes, the Ufer ground, along with several plate grounds, will provide an adequate path to ground for proper grounding of electrical systems, electrical equipment, and fault current.

A lightning protection evaluation of the previous facility indicated the need for a lightning protection system. A thorough review and evaluation will be performed during the title design phase. If necessary, a lightning protection system will be provided, but due to the nature of the structure (the fabric skin), a standard lightning protection system comprised of numerous air terminals and down conductors will not be feasible.

3.6.2 Electrical Load Requirements

The retrieval facility has two electrical feeds. The main commercial feed supplies a 2,000 kVA electrical service via a 4,160/480 V transformer for all the nonstandby loads. The second feed will be the generator backed stand-by feeder that will supply the facility with 1,000 kVA of stand-by power via a 4,160/480V transformer. Applicable codes and standards do not require a standby generator, however, prudent design practices dictate the availability of a standby system. The generator will be classified as a standby generator as specified by NFPA 70, "National Electrical Code." The power demands for the two distribution systems are listed in Table 2.

3.6.3 Lighting

Metal Halide lamps will provide lighting in most areas with. Metal Halide was chosen because of its color rendering qualities, making it an excellent choice for video illumination. Self-contained, battery-backed fixtures specifically designed for emergency use in accordance with NFPA 101, "Life Safety Code," will provide emergency egress and exit lighting.

Table 2. Power demand for the two distribution systems.

Component	kVA	% lag PF
Normal Power		
Lighting	399	80
Ventilation	350	80
Heat	672	100
Breathing Air Compressor	29	80
Dust Filter Air Compressor	58	80
Office Equipment	42	80
Miscellaneous Loads	300	80
Total	1,762	92
Standby Power		
Lighting	266	80
Ventilation	150	80
Heat	374	100
Office Equipment	30	80
Miscellaneous Loads	50	80
Total	851	92

3.6.4 Instrumentation

Instrumentation for the retrieval facility will consist of a monitoring and control system, a radiation monitoring system, an emissions monitoring system, a criticality alarm system, and a closed circuit television system.

Monitoring and Control System. The monitoring and control system will perform the overall monitoring and control of the retrieval facility. A programmable logic controller will be used for this control process. The controller monitors operating conditions such as pressure differences across confinement barriers, ventilation flow, and temperature. If conditions exceed limiting conditions of operation, the controller initiates a predetermined response. This response repositions final control elements or simply notifies operators of conditions that do not conform to operating requirements. The controller is also used to control or maintain required operating conditions. For example, it will monitor differential pressures between various zones, areas, and rooms and output a signal to a variable frequency drive that controls the speed of a ventilation fan in order to maintain an acceptable differential pressure between the areas for confinement purposes. It will also log any abnormal events and trend conditions of particular interest.

The monitoring and control system consists of one or more processors along with input/output, power supply, and communication modules. With the flexibility of today's industrial-hardened programmable logic controllers and the wide variety of input/output modules offered, a controller system(s) readily supports the operation of the retrieval facility. The ability to program and read controller languages is well established at the INEEL, and has proven to be very reliable. The input/output modules are both analog (4–20 mA) and discrete (24 Vdc). Given the operating conditions in the retrieval facility, technicians will be able to safely maintain the monitoring and control system. To permit operators to readily observe operating conditions, the system also has one or more human machine interface stations. The operation of the retrieval facility is presented to operators by user-friendly graphic screens. These same screens also assist maintenance and engineering in trouble-shooting nonconforming conditions.

The facility sensing instrumentation should consist of commercially available equipment that is already common at the INEEL. This is important since it will be a benefit in the purchase, installation design, calibration, and operation of the sensors.

Radiation Monitoring System. The radiation monitoring system is similar to the equipment used in the GEM project. While the design, construction, and operation of the facility carefully addresses protecting operators from radiological exposure and contamination, potential hazards still exist. To mitigate these potential hazards, the retrieval facility has a variety of radiation monitoring equipment. Two types of instruments used extensively throughout the manned areas of the facility are radiation area monitors and continuous air monitors. The radiation monitors notify operators of conditions where they are being exposed to excessive levels of gamma radiation from the waste being excavated and transported. The continuous air monitors notify operators of airborne radioactive contamination in occupied areas. Should either monitor alarm, a radiological technician and/or established procedures provide operators with instructions on how to respond to such unlikely events.

In addition to the possibility of airborne contamination detectable by a continuous air monitor, contamination may be present on an operator's skin or clothing. Personnel contamination monitors will be located at control boundaries in the retrieval facility. Within a few minutes, a whole body survey can be completed to determine whether external contamination exists on an individual. This survey is essential to protect the individual as well as prevent the spread of contamination outside the boundaries of radiologically controlled areas. In addition to these three monitors, the retrieval facility will have localized hand-held surveying devices for use by personnel.

Because of the large area enclosed by the retrieval facility and the extended period of operation compared to the GEM project, the radiation monitoring equipment will be monitored centrally. The previously described programmable logic controller of the monitoring and control system can readily support the monitoring of this equipment or a separate monitoring system can be used.

Emissions Monitoring System. The HEPA filters in the retrieval facility's ventilation system are designed to remove radioactive contamination from the ventilation air before it is exhausted to the outside environment. While these filtration systems are very effective in removing radioactive airborne contaminants, the potential exists for some contaminants to pass through the filters and be exhausted to the environment. Further, there is a small potential for the HEPA filters to experience off-normal conditions and allow excessive airborne contamination to be exhausted to the environment. The retrieval facility is required to have an emission monitoring system that addresses the possibility of contaminants being released from the stack and to determine dose calculations. The system consists of a sampling system, a collection filter, and a real time monitoring system. It withdraws samples from the retrieval exhaust stack with precisely manufactured sample nozzles. The configuration of the nozzles is critical to capturing a representative sample of exhaust air. The total stack and sample flow rates are quantified. Their ratio can then be used to determine the total contamination released to the environment. The official release of contamination is determined from the analysis of a filter that is inserted into one sample stream and allowed to collect contamination for a period of days. However, to determine if a sudden off-normal condition has developed, one sample stream is passed through a continuous air monitor for an immediate determination of contamination release. Such a release would be addressed immediately by operations for remedial action.

Another system will be used to monitor the stack for volatile organic compounds (VOCs). The organic compound in the vadose zone project plans to utilize a Fourier Transform Infrared spectroscopy system to analyze gas streams for VOCs. Preliminary evaluations determined that this system would be a preferred alternative for continuous VOC monitoring, if necessary for this project.

The Fourier Transform Infrared spectroscopy system is contained in a mobile unit and will be stationed at a suitable location in the exhaust ventilation path. It will likely operate independently of the system monitoring for airborne contamination.

Criticality Alarm System. Although a criticality in the retrieval facility is extremely unlikely, it may not be incredible. Therefore, a criticality alarm system is included in the facility instrumentation. The key features of the system are detection and alarm. A trio of detectors and their associated controls and voting logic will perform detection. The criticality alarm system is configured with three separate detectors to ensure that a criticality is detected while preventing false alarms. At least two of the three detectors must reach a high-condition setpoint before an alarm is actually generated. Once a high alarm has been generated by the system logic, the local control enclosure will alarm. In addition, to ensure that everyone in the affected area is notified, a system of audible and visual alarms throughout the facility interior and exterior will be actuated to effect an evacuation. For the Pit 9 facility, the area of retrieval and transport is large enough that more than one criticality alarm system unit is assumed to be required. Since this is the case, a central monitoring system is necessary to log a postulated criticality and provide information to remote locations in order to permit Operations to recover from the accident. The programmable logic controller above can be used for this hnction provided the problem of depending upon interfacing a safety related system to a nonsafety related system is resolved.

Closed Circuit Television System. A closed circuit television system will be used in the retrieval operation for at least two important reasons:

- First, it will help operators efficiently control and protect equipment during the removal/transport of waste in such a large retrieval area using remote controls.

- Second, it will give personnel from various organizations such as Operations, Environmental Sciences, Security, and outside agencies the ability to observe the retrieval operation either live or via recordings without actually visiting the facility.

With these two purposes in mind, the television system will need several key features. The operators of the retrieval/transport equipment will need a series of cameras located throughout the facility. Most of the cameras will have a fixed location, enabling the observation of operations. Each camera will have a pan/tilt/zoom function. Operators will be able to select the camera that offers the best view of the area of interest and then focus on that area. Experience from GEM project has shown that the operators will have a detailed view of the operations that would exceed the details they would normally see if they were actually sitting on the retrieval/transport equipment without camera assistance. All of the cameras can be viewed from a central television monitoring station. This central monitoring station will have the ability to control the pan/tilt/zoom function of the cameras much like the operating stations. In addition to the capability to observe the cameras at the monitoring station, all the cameras will have their video recorded at the central monitoring station. The recording is initially stored on a computer hard-drive and later loaded onto DVDs. Digital recording minimizes recording time. If the system senses no change in the picture, the recording stops or sleeps. Once movement takes place, the system wakes-up and starts the recording process. This eliminates long periods or recording for which no activity takes place. All recordings will have a time and date stamp for future reference. The final key feature of the closed circuit television system is the remote viewing of the retrieval operation. The selection of remote viewing locations will be determined during conceptual design.

3.6.5 Life Safety Systems

The facility will be provided with a fire alarm system. The system will transmit annunciation of fire alarm, supervisory, and trouble conditions to the INEEL Proprietary Fire Alarm Monitoring System using the Digital Alarm Communication Transmitter/Digital Alarm Communication Receiver monitoring equipment.

The system will include the control panel, backup power supply, manual fire alarm stations, occupant notification audible and visual signals, and monitoring for the installed fire protection systems—wet and dry sprinkler systems and water-mist fire extinguishing system. The system will report alarm, trouble, and supervisory alarm conditions to the INEEL Fire Alarm Center.

Adequate personnel emergency exits are provided, including exit doors with emergency exit hardware and exit signs and emergency lights. Local emergency notification is made by the fire alarm system and audible/visual occupant notification appliances. Manual fire alarm stations are provided at the exits. In addition, site evacuation and take-cover signals will be provided and connected to the RWMC evacuation system.